

1 **METHOD FOR BONDING AN INTEGRATED CIRCUIT DEVICE TO A GLASS**
2 **SUBSTRATE**

3
4 **BACKGROUND OF THE INVENTION**

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6 The present application is a continuation-in-part of
7 U.S. Application Serial Number 10/028,880, filed December
8 20, 2001, now pending.

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10 **Field of the invention**

11 The invention relates to a method for bonding an
12 integrated circuit device to a glass substrate; in
13 particular, the invention relates to a method that can bond
14 the integrated circuit device to the glass substrate
15 without suffering from damages by sharp edges of the glass
16 substrate.

17
18 **Description of the related art**

19 Referring to Fig. 1a, Fig. 1b, Fig. 1c, Fig. 1d and
20 Fig. 1e, a conventional method for bonding an integrated
21 circuit device to a glass substrate, comprises the
22 following steps. After the glass substrate 10 is scribed
23 and broken, as shown in step S1 of Fig. 1a, it is ground at
24 its edges by a grinding device 11, as shown in Fig. 1b and
25 in step S2 of Fig. 1a. Thus, a beveled angle 101 is formed
26 at the edges, as shown in Fig. 1c. Then, the ground
27 substrate glass 10 is cleaned by a cleaning device 12, as
28 shown in Fig. 1c and in step S3 of Fig. 1a. Finally, the
29 integrated circuit device 13 is bonded to the glass
30 substrate 10, as shown in Fig. 1d and Fig. 1e and in step
31 S4 of Fig. 1a. It is noted that the integrated circuit

1 device 13 comprises a driver circuit 131 and a main board
2 133. The driver circuit 131 and the main board 133 are
3 bonded to a circuit 14 on the glass substrate 10 via a
4 connecting wire 132. The driver circuit 131 may be located
5 on the main board 133, as shown in Fig. 1d, or located on
6 the connecting wire 132, as shown in Fig. 1e. In summary,
7 the connecting wire 132 of the integrated circuit device 13
8 is bonded to the circuit 14 of the glass substrate 10. In
9 addition, the connecting wire 132 is bonded to the circuit
10 14, disposed on the glass substrate 10, via an adhesive 15
11 and plural conductive particles 16.

12 In the above step S2, grinding is used to improve the
13 contact area between the integrated circuit device 13 and
14 the glass substrate 10. As a result, the integrated
15 circuit device 13 is not damaged by the sharp edges of the
16 glass substrate 10.

17 The conventional method has the following
18 disadvantages:

19 1. There is debris and dust produced when the grinding
20 device grinds the glass substrate.

21 2. Post-bonding process is required, such as cleaning.

22 3. Referring to Fig. 1f, the glass substrate may be
23 used as a liquid crystal display panel 10 that comprises
24 two substrates 1, 2, seal 3 and liquid crystal 4 disposed
25 between the substrates 1, 2. After the cleaning process,
26 vapors may diffuse into the liquid crystal 4 through the
27 seal 3 so as to damage the liquid crystal 4.

28 4. Since the process is troublesome, its throughput is
29 low.

30

SUMMARY OF THE INVENTION

In order to address the disadvantages of the aforementioned bonding method, the invention provides a method that can bond an integrated circuit device to a glass substrate in a shorter time.

Accordingly, the invention provides a method for bonding an integrated circuit device to a glass substrate. The method comprises the following steps. First, a melting device is provided, and the melting device melts a predetermined portion of the glass substrate. Then, the integrated circuit device is bonded to the glass substrate.

Furthermore, the melting device is a laser device.

In a preferred embodiment, a protecting circuit, connecting with an external circuit, is disposed on the glass substrate, and the melting device comprises a first laser device for eliminating the protecting circuit and a second laser device for eliminating the predetermined portion of the glass substrate.

In a preferred embodiment, the integrated circuit device comprises a driver circuit, a connecting wire, and a main board, and the connecting wire is in contact with the predetermined portion, melted by the melting device, of the glass substrate when the integrated circuit device is bonded to the glass substrate.

Furthermore, the connecting wire is bonded to the protecting circuit of the glass substrate via an adhesive and a plurality of conductive particles.

In a preferred embodiment, the predetermined portion of the glass substrate is located at the edges of the glass substrate.

In a preferred embodiment, the invention provides

1 another method for bonding an integrated circuit device to
2 a glass substrate. The method comprises the following
3 steps. First, one portion of the integrated circuit device
4 is bonded to a predetermined portion of the glass substrate
5 so that a gap is formed between the other portion of the
6 integrated circuit device and the glass substrate. Then,
7 resin is introduced into the gap so that the resin covers
8 the predetermined portion of the glass substrate.

9 Furthermore, the resin is cured by ultraviolet light.

11 BRIEF DESCRIPTION OF THE DRAWINGS

12 The invention is hereinafter described in detail with
13 reference to the accompanying drawings in which:

14 Fig. 1a is a schematic view depicting a conventional
15 method for bonding an integrated circuit device to a glass
16 substrate;

17 Fig. 1b is a schematic view depicting a step S2 as
18 shown in Fig. 1a;

19 Fig. 1c is a schematic view depicting a step S3 as
20 shown in Fig. 1a;

21 Fig. 1d and Fig. 1e are schematic views depicting a
22 step S4 as shown in Fig. 1a;

23 Fig. 1f is a cross-section depicting a liquid crystal
24 display panel;

25 Fig. 2a is a schematic view depicting a first
26 embodiment of a method for bonding an integrated circuit
27 device to a glass substrate, as disclosed in this
28 invention;

29 Fig. 2b and Fig. 2c are schematic views depicting a
30 step S12 as shown in Fig. 2a;

31 Fig. 2d and Fig. 2e are schematic views depicting a

1 step S13 as shown in Fig. 2a;

2 Fig. 3a is a schematic view depicting another
3 embodiment of a melting device as disclosed in the first
4 embodiment;

5 Fig. 3b is a schematic view depicting the protecting
6 circuit after melting;

7 Fig. 4a is a schematic view depicting a second
8 embodiment of a method for bonding an integrated circuit
9 device to a glass substrate, as disclosed in this
10 invention;

11 Fig. 4b and Fig. 4d are schematic views depicting a
12 step S22 as shown in Fig. 4a; and

13 Fig. 4c and Fig. 4e are schematic views depicting a
14 step S23 as shown in Fig. 4a.

15

16 **DETAILED DESCRIPTION OF THE INVENTION**

17 **First embodiment**

18 Referring to Fig. 2a, Fig. 2b, Fig. 2c, Fig. 2d and
19 Fig. 2e a method for bonding an integrated circuit device
20 to a glass substrate, of a first embodiment of this
21 invention comprises the following steps. First, a glass
22 substrate 20 is provided. After the glass substrate 10 is
23 scribed and broken, as shown in step S11 of Fig. 2a, a
24 melting device 30 is provided, and the melting device 30
25 melts a predetermined portion of the glass substrate 20, as
26 shown in Fig. 2b and step S12 of Fig. 2a. It is noted that
27 the predetermined portion of the glass substrate 20 is
28 located at an edge of the glass substrate 20 in Fig. 2b.
29 After performing the step S12, a round angle 21 is formed
30 at the edge of the glass substrate 20, as shown in Fig. 2c.
31 Then, an integrated circuit device 40 is provided, and is

1 bonded to the glass substrate 20, as shown in Fig. 2d and
2 Fig. 2e and step S13 of Fig. 2a.

3 It is noted that only one integrated circuit device
4 and portion of the edge of the glass substrate are shown in
5 Fig. 2b, Fig. 2c, Fig. 2d and Fig. 2e. However, in
6 practice, the melting device 30 may melt the whole one
7 edge, as shown in Fig. 3a, or melt four edges on the glass
8 substrate. In addition, a plurality of integrated circuit
9 devices may be disposed on the glass substrate at a time.

10 As shown in Fig. 2b, the melting device 30 simply
11 comprises a single laser device. However, the melting
12 device may be shown as Fig. 3a because a protecting circuit
13 22, electrically connecting with an external circuit (not
14 shown), is disposed on the glass substrate 20.

15 Specifically, the melting device 30 may comprise a first
16 laser device 31 for eliminating a predetermined portion 221
17 of the protecting circuit 22 and a second laser device 32
18 for eliminating the predetermined portion 23 of the glass
19 substrate 20. In Fig. 2b, since the melting device 30
20 simply comprises a single laser device, depending on the
21 eliminating object, the intensity of the laser device needs
22 to be adjusted. In Fig. 3a, since the melting device 30
23 comprises two laser devices, depending on the eliminating
24 object, the laser devices need to be switched.

25 Specifically, the second laser device 32 serves to melt the
26 predetermined portion (edge) 23 of the glass substrate 20,
27 and not to cut the glass substrate 20. Thus, the second
28 laser device 32 must emit laser light with long wavelength.
29 In a situation that the protecting circuit 22 is located on
30 the glass substrate 20, the laser light with long
31 wavelength would be reflected by metallic electrodes

1 constituting the protecting circuit 22. Thus, the edge 23
2 of the glass substrate 20 cannot be completely melted. As
3 a result, the first laser device 31 serves to emit laser
4 light with short wavelength to eliminate the portion
5 connecting to the edge 23 of the glass substrate 20 of the
6 protecting circuit 22, as shown in Fig. 3b. The edge 23 of
7 the glass substrate 20 is then melted by the laser light
8 with long wavelength emitted by the second laser device 32.

9 As shown in Fig. 2d and Fig. 2e, the integrated
10 circuit device 40 comprises a driver circuit 41, a
11 connecting wire 42, and a main board 43. The connecting
12 wire 42 is in contact with the predetermined portion
13 (smooth angle 21), melted by the melting device 30, of the
14 glass substrate 20 when the integrated circuit device 40 is
15 bonded to the glass substrate 20. In addition, like the
16 conventional method, the connecting wire 42 is bonded to
17 the protecting circuit 22 of the glass substrate 20 via an
18 adhesive 51 and a plurality of conductive particles 52.

19 As stated above, in this embodiment, since the edge of
20 the glass substrate is melted by laser, there is no debris
21 and dust produced. Thus, no post-bonding process is
22 required to prevent vapors diffusing into the substrate.
23 As a result, the whole process time is reduced, and the
24 throughput is enhanced.

25

26 Second embodiment

27 Referring to Fig. 4a, Fig. 4b, Fig. 4c, Fig. 4d and
28 Fig. 4e, a method for bonding an integrated circuit device
29 to a glass substrate, of a second embodiment of this
30 invention comprises the following steps. First, a glass
31 substrate 20 and an integrated circuit device 40 are

1 provided. After the glass substrate 20 is scribed and
2 broken, as shown in step S21 of Fig. 4a, one portion (the
3 connecting wire 42) of the integrated circuit device 40 is
4 bonded to a predetermined portion (the protecting circuit
5 22 disposed on the glass substrate 20) of the glass
6 substrate 20 so that a gap G is formed between the other
7 portion of the integrated circuit device 40 and the glass
8 substrate 20, as shown in Fig. 4b and Fig. 4d and step S22
9 of Fig. 4a. Then, resin 60 is filled into the gap G so
10 that the resin 60 covers the predetermined portion (edge
11 23) of the glass substrate 20, as shown in Fig. 4c and Fig.
12 4e and step S23 of Fig. 4a.

13 The resin 60 is cured by ultraviolet light. The
14 connecting wire 42 is not in contact with the edge 23 of
15 the glass substrate 20 due to the resin 60 when the
16 integrated circuit device 40 is bonded to the glass
17 substrate 20. Thus, there is no damage generated on the
18 integrated circuit device 40.

19 In this embodiment, since the edge of the glass
20 substrate is covered by the resin, no grinding process is
21 required. Thus, there is no debris and dust produced and
22 no post-bonding process is required to prevent vapors
23 diffusing into the substrate. As a result, the whole
24 process time is reduced, and throughput is enhanced.

25

26 While the invention has been particularly shown and
27 described with reference to a preferred embodiment, it will
28 be readily appreciated by those of ordinary skill in the
29 art that various changes and modifications may be made
30 without departing from the spirit and scope of the
31 invention. It is intended that the claims be interpreted to

- 1 cover the disclosed embodiment, those alternatives which
- 2 have been discussed above, and all equivalents thereto.